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EXAMINER	
DHINGRA, RAKESH KUMAR	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/595,203	SI ET AL.	
	Examiner	Art Unit	
	RAKESH K. DHINGRA	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *03* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *06 May 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-11* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *23 March 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 5/6/09 has been entered.

Response to Arguments

Applicant's arguments with respect to claims 1-11 have been considered but are moot in view of the new ground(s) of rejection as explained hereunder.

Applicant has amended claims 1, 2 by adding new limitations, e.g. in claim 1 new limitation "wherein openings of the first spray hole are substantially perpendicular to openings of the second spray hole", has been added.

Claims 1-11 are presently pending and active.

References by Toyoda, Carson and Srivastava when combined read on limitation of amended claim 1 as explained below. Specifically, Kanai reference has been dropped and rejection has been amended as explained below.

Response to applicant's arguments regarding claim rejections is given hereunder.

Applicant argues that Carson does not teach i) The inner tube has a lengthwise constant diameter all the way from one end to the other; ii) The outer tube has the fluid outlet ports 8, holes drilled into the side walls of the outer tube (See col. 2, lines 59-60); iii) There is NO gap

between the closed end of the inner tube and the end with the fluid outlet ports of the outer tube (See Fig. 1); and iv) The process gas is supplied to the inner tube AND outer tube from the fluid inlet means 2 and 3 (See col. 2, lines 49-53).

Examiner responds that Carson teaches a fluid supply apparatus that enables mixing of fluids before supply into a process vessel 1 comprising an inner tube 5 whose one end (towards gas inlet 11) is open and the other end 9 is closed, first spray holes 7 formed in side wall of the inner tube 5 near its closed end, and an outer tube 4 with one end that is open through which the inner tube passes, while the other end of the outer tube (outlet ports 8) is spaced apart a predetermine distance from the closed end (outlet ports 7) of the inner tube (e.g. Fig. 1 and col. 2, lines 18-65). Thus, Carson teach a predetermined distance (gap) between the closed end of the inner tube and the end with the fluid outlet ports of the outer tube. Regarding inner tube diameter Toyoda et al teach (Fig. 12) the diameter of the inner 22 is variable. Unless disclosed to be critical, the size of relative diameters of the one and other ends of the inner tube would be dependent upon process limitations like gas flow rate, desired level of mixing of gas before supply into the process chamber etc, and thus could be optimized accordingly. Examiner notes that claim does not recite, if the diameter referred in the claim is the bore or the external diameter of the inner tube. Regarding outer tube 4 having fluid outlet ports 8 drilled in its side wall, examiner responds that Toyoda already teaches second spray holes formed at the end of the outer tube that s connected with the reaction tube 1 (Fig. 12). Further, regarding fluid inlet to the inner tube, the same is supplied from the outlet of the discharge tube 2 (Toyoda et al – Fig. 12){it is relevant that one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208

USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir.1986)}. It would be obvious to one of ordinary skills in the art to modify the supply port of Toyoda et al so as to provide the inner tube concentrically with the outer tube and provide the first spray port in a side wall of the inner tube near its closed end as per teaching of Carson to enable mixing of the activated gas in the annular space between the inner and outer tube and make a uniform supply of the activated gas to the reaction tube. Thus, Toyoda in view of Carson and Srivastava teach all limitations of claim 1 as explained below. Accordingly claims 1, 2, 4 have been rejected under 35 USC 103 (a) as explained below. Further, balance claims 3 and 5-11 have also been rejected under 35 USC 103 (a) as explained below.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any

evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1, 2, 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Toyoda et al (US 2001/0029112) in view of Carson (US 3,818,938) and Srivastava et al (US 6,761,796).

Regarding Claims 1, 4: Toyoda et al teach a plasma apparatus comprising:

A chamber 1 having a supply port 22 and an exhaust port (part of manifold 7A) provided at both ends thereof, with a wafer 4 being mounted in the chamber, a gas supply module for supplying process gas (through gas inlet 8C), a discharge tube 2 (made from quartz) for plasmalizing the process gas supplied from the gas supply module, and a microwave supply apparatus (through waveguide 71) for supplying microwaves to the discharge tube, wherein the supply port supplies atomic radicals to the chamber, the radicals being formed by the plasmalization of the process gas in the discharge tube 2, and wherein the supply port includes:

an inner tube 82 having one end which is opened and connected to the discharge tube and a first spray hole 83 being formed at the end of the inner tube,

an outer tube 7B having one end which is opened such that the other end closed portion of the inner tube is inserted in the one end, and the other end at which a plurality of second spray holes is formed, and

wherein the inner tube and the outer tube are disposed such that the process gas in a radical state is mixed in a space between the inner tube and the outer tube so that uniformity of pressure of the process gas is attained and sprayed toward outside through the second spray holes. Toyoda et al also teach that spray hole 83 can have various shapes such as circle, rectangular etc (e.g. Figs. 5, 12, 13 and para. 0057-0063, 0095-0100).

Toyoda et al do not teach a thermal source provided in the chamber and including a plurality of lamps for heating the wafer; the other end of the inner tube is closed, the diameter of a closed portion of the other end of the inner tube being smaller than those of other portions of the other end, and the first spray hole being formed at the end of the inner tube around a side wall of the closed portion; and the other end of the outer tube being spaced apart by a predetermined interval from the other closed end of the inner tube, and wherein openings of the first spray hole are substantially perpendicular to openings of the second spray holes.

Carson teaches a fluid supply apparatus that enables mixing of fluids before supply into a process vessel 1 comprising an inner tube 5 whose one end (towards gas inlet 11) is open and the other end 9 is closed, first spray holes 7 formed in side wall of the inner tube 5 near its closed end, and an outer tube 4 with one end that is open through which the inner tube passes, while the other end of the outer tube (outlet ports 8) is spaced apart a predetermine distance from the closed end (outlet ports 7) of the inner tube (e.g. Fig. 1 and col. 2, lines 18-65). It would be obvious to provide the inner and outer tube arrangement as taught by Carson in the apparatus of Toyoda et al to enable mix the active species properly before supply of the same to the process chamber. Further, the openings 7 of the inner tube 5 would be (in a plane) substantially perpendicular to the (plane of) of the second openings in the outer tube of Toyoda et al. Further

still, Toyoda et al teach (Fig. 12) the diameter of the inner 22 being variable. Unless disclosed to be critical, the size of relative diameters of the one and other ends of the inner tube would be a matter of choice depending upon process limitations like gas flow rate, level of desired mixing of gas before supply into the process chamber etc and could be optimized accordingly.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to modify the supply port of Toyoda et al so as to provide the inner tube concentrically with the outer tube and provide the first spray port in a side wall of the inner tube near its closed end as per teaching of Carson to enable mixing of the activated gas in the annular space between the inner and outer tube and make a uniform supply of the activated gas to the reaction tube.

Toyoda et al in view of Carson do not teach a thermal source provided in the chamber and including a plurality of lamps for heating the wafer, the supply port and the exhaust port provided at both ends of the chamber.

Srivastava et al teach a microwave remote plasma apparatus for photo-resist stripping comprising a processing chamber 16 with a thermal source comprising a plurality of lamps 58 and having supply and exhaust ports 51, 26 provided at both ends of the chamber (e.g. Fig. 1 and col. 3, line 55 to col. 6, line 15).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide a thermal source comprising of lamps inside the chamber as taught by Srivastava et al in the apparatus of Toyoda et al in view of Carson to enable precisely control the temperature on the wafer surface.

Regarding Claim 2: Toyoda et al in view of Carson and Srivastava et al teach the supply port 7B and the exhaust port 7A, 9A are arranged at side walls of the chamber 1, the inside of the

chamber is symmetrical on a plane passing the bottom of the chamber 1 about a virtual line passing a lowest bottom point of the supply port and a center point of an opening of the exhaust port, and wherein the bottom of the chamber is formed in parallel with the wafer (Toyoda et al – Figs. 6, 9-13). Further, Srivastava et al also teach inlet and exhaust ports 51, 26 are arranged at side walls (top side and bottom sides) of the chamber 16, and inside of chamber is symmetrical on a plane passing the bottom of the chamber 16 about a virtual line passing a lowest bottom point of the supply port 51 and a center point of an opening of the exhaust port 26, and wherein the chamber bottom is formed parallel to the wafer (Fig. 1) {examiner notes that applicant's disclosure (Figs. 1, 3 and page 3, lines 6-9) discloses "Preferably, the supply port and the exhaust port are arranged at side walls of the chamber, the inside of the chamber is symmetrical on the basis of a virtual line connecting the supply port and the exhaust port, and the bottom of the chamber is formed in parallel with the wafer". The disclosure does not disclose claim 2 limitation "bilaterally symmetrical on a plane passing the bottom of the chamber about a virtual line passing lowest bottom point of the supply port and a center point of an opening of the exhaust port". Specifically the disclosure does not disclose symmetry with respect to lowest bottom point of the supply port and a center point of an opening of the exhaust port. Applicant is requested to indicate support for this part of the limitation or amend the claim}.

Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Toyoda et al (US 2001/0029112) in view of Carson (US 3,818,938) and Srivastava et al (US 6,761,796) as applied to claims 1, 2, 4, and further in view of Sojoto et al (US 2002/0015855).

Regarding Claim 3: Toyoda et al in view of Carson and Srivastava et al teach all limitations of the claim except heating apparatus arranged around the supply port.

Sojoto et al teach a plasma apparatus with a chamber 112 that has a supply port 138 for receiving a heated gas delivery feed-through 140, having an inlet 142 and an outlet 144 to deliver one or more precursor gases into the gas distribution plate 126 mounted on the chamber lid assembly 114 (e.g. Fig. 3 and para. 0045).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide a heating apparatus around the supply port as taught by Sojoto et al in the apparatus of Toyoda et al in view of Carson and Srivastava et al to enable control the temperature of the activated species for improved control of the plasma process.

Claims 5, 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Toyoda et al (US 2001/0029112) in view of Carson (US 3,818,938) and Srivastava et al (US 6,761,796) as applied to claims 1, 2, 4 and further in view of Zheng et al (US 2003/0066486).

Regarding Claim 5: Toyoda et al in view of Carson and Srivastava et al al teach all limitations of the claim except length of supply port.

Zheng et al teach a plasma applicator with a chamber 430 that has a supply port 325 whose length is greater than the thickness of the wall of the chamber. Though Zheng et al do not explicitly teach the length of the supply port to be less than 100 mm, the same is related to functional limitations and would be selected (optimized) based upon process parameters like thickness of chamber wall, gas pressures, pumping speeds etc. (e.g. Figs. 3A-3C and para. 0072-0085).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to optimize the length of the supply port as taught by Zheng et al in the apparatus of Toyoda et al in view of Carson and Srivastava et al as per process limitations like thickness of chamber wall, gas pressures, pumping speeds etc.

In this connection courts have ruled:

It would have been obvious to one having ordinary skill in the art to have determined the optimum value of a cause effective variable through routine experimentation in the absence of a showing of criticality. *In re Woodruff*, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Regarding Claim 6: Zheng et al teach the supply port 325 can have a diameter of 1 inch which meets the claim limitation of 15-25 mm (para. 0098).

Claims 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Toyoda et al (US 2001/0029112) in view of Carson (US 3,818,938) and Srivastava et al (US 6,761,796) as applied to claims 1, 2, 4 and further in view of Mahawili (US 6,544,339).

Regarding Claim 7: Toyoda et al in view of Carson and Srivastava et al teach all limitations of the claim including a supply port connected 51 connected to microwave plasma apparatus, and the supply port 51 and the exhaust port 26 being oppositely arranged in a one to one correspondence in the chamber (Srivastava et al – Fig. 1).

Toyoda et al in view of Carson and Srivastava et al do not teach at least two supply ports and at least two exhaust ports in the chamber.

Mahawili teaches a plasma apparatus with a chamber that has a plurality of supply ports and a plurality of exhaust ports. Mahawili further teaches that the configuration of supply and exhaust ports is optimized based upon required gas flow distribution and process uniformity consideration (e.g. Figs. 3-5 and col. 6, line 30 to col. 8, line 40).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to optimize the number and configuration of supply and exhaust ports in the chamber as taught by Mahawili in the apparatus of Toyoda et al in view of Carson and Srivastava et al as per process limitations like gas flow distribution and process uniformity requirements.

In this connection courts have ruled:

It would have been obvious to one having ordinary skill in the art to have determined the optimum value of a cause effective variable through routine experimentation in the absence of a showing of criticality. *In re Woodruff*, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Claims 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Toyoda et al (US 2001/0029112) in view of Carson (US 3,818,938) and Srivastava et al (US 6,761,796) as applied to claims 1, 2, 4 and further in view of Sawayama et al (US 2003/0164225).

Regarding Claim 8: Toyoda et al in view of Carson and Srivastava et al teach all limitations of the claim including a chamber 1, having a supply port 8A, 8B and exhaust port 9A, 9B provided at both ends thereof, with a wafer 4 being mounted in the chamber. Toyoda et al further teach an exhaust plate 7A that includes wafer transfer port (adjacent the gate valve 6) and the exhaust port 9A (Figs. 5, 6 and para. 0056-0061).

Toyoda et al in view of Carson and Srivastava et al do not teach an exhaust plate on which a cooling water path is formed is arranged on a side wall opposite to the side wall on which the supply port is provided, a wafer transfer port and the exhaust port being arranged at the exhaust plate 180.

Sawayama et al teach a plasma apparatus comprising a processing chamber 6001; an exhaust pump (rotary pump and mechanical booster pump) 6002 with exhaust pipe 6003, exhaust means 6018 and water cooling means 6021, a cooling means 6021 that uses water cooling the exhaust means 6018 (e.g. Fig. 30 and para. 0173). It would be obvious to provide the water cooling means as taught by Sawayama et al in the apparatus of Toyoda et al in view of Carson and Srivastava et al to enable control the temperature of the gaseous exhaust products and the temperature of the wafer.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide water cooling path on the exhaust plate as taught by Sawayama et al in the apparatus of Toyoda et al in view of Carson and Srivastava et al to enable control the temperature of the gaseous exhaust products and the temperature of the wafer.

Claims 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Toyoda et al (US 2001/0029112) in view of Carson (US 3,818,938) and Srivastava et al (US 6,761,796) as applied to claims 1, 2, 4 and further in view of Tay et al (US 6,075,922).

Regarding Claim 9: Toyoda et al in view of Carson and Srivastava et al teach all limitations of the claim including lamps 58 of thermal source that heat the wafer in an upward

direction (Srivastava et al – Fig. 1) and a supply port 22 that is arranged so that process gas is sprayed in parallel with the wafer in the chamber (Toyoda et al – Fig. 12).

Toyoda et al in view of Carson and Srivastava et al do not teach that lamps are arranged to emit light in a downward direction and that the lamps and the supply port are arranged such that a radiation region of light emitted from the lamps and a spray region of the process gas coincide with each other above the wafer.

Tay et al teach a thermal that includes a thermal source with lamps 26 that heat a wafer 14 in a downward direction (e.g. Fig. 1 and col. 6, line 15 to col. 7, line 20). Further, since the lamps 26 heat the wafer in a down ward direction and the supply port 44 of Davis et al supplies activated gas parallel to the substrate, a radiation region of light emitted from the lamps and a spray region of the process gas would obviously coincide with each other above the wafer.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide thermal source with lamps that emit light in a downward direction as taught by Tay et al in the apparatus of Toyoda et al in view of Carson and Srivastava et al to obtain heating of wafer simultaneous with the reaction process on the wafer surface.

Claims 10, 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Toyoda et al (US 2001/0029112) in view of Carson (US 3,818,938) and Srivastava et al (US 6,761,796) as applied to claims 1, 2, 4 and further in view of Davis et al (US 2002/0144706).

Regarding Claim 10: Toyoda et al in view of Carson and Srivastava et al teach all limitations of the claim including that chamber is evacuated to vacuum, but do not explicitly

teach the apparatus includes a discharge pressure control valve and a vacuum pump are arranged at the exhaust port.

Davis et al teach a remote plasma apparatus comprising a remote plasma source 41 (discharge tube) that supplies activated species to a process chamber 12 through a supply port 44 for processing a wafer mounted on a pedestal 18. Davis et al further teach a gas source 38 that supplies process gas and an exhaust port 48. Davis et al additionally teach the apparatus comprises a vacuum pump 50 and a discharge control valve 53a (Figs. 1-7 and para. 0007, 0032-0060).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide discharge pressure control valve and vacuum pump as taught by Davis et al in the apparatus of Toyoda et al in view of Carson and Srivastava et al to enable obtain vacuum in the process chamber for carrying out the wafer processing.

Regarding Claim 11: Davis et al teach that the supply port 44 is designed so that divergent stream of activated gas is supplied over the wafer surface (para. 0034).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RAKESH K. DHINGRA whose telephone number is (571)272-5959. The examiner can normally be reached on 8:30 -6:00 (Monday - Friday).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571)-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/R. K. D./
Examiner, Art Unit 1792

/Karla Moore/

Primary Examiner, Art Unit 1792